

Evaluation of the Use of a Tubularized Vascularized Skin Flap from Dorsal Penile Skin with a Modification of Skin Covering for Proximal Hypospadias Cripples

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Abstract: **Background:** Surgical techniques to repair crippled hypospadias have undergone remarkable advances in recent years with the development and widespread use of dorsal penile skin to facilitate urethroplasty. **Objective:** To evaluate the use of tubularized vascularized skin flap from dorsal penile skin with a modification of skin covering in management of proximal hypospadias cripples. **Patients and Methods:** This study was carried out on 35 patients with crippled hypospadias, managed with tubularized vascularized skin flap from dorsal penile skin with a modification of skin covering at Al-Azhar university hospitals from November 2019 till May 2021. **Results:** Our experience with 35 cases of proximal crippled hypospadias shows that urethroplasty using tubularized skin flap from dorsal penile side with modification can be used as an alternative technique with low complication rate for repairing proximal crippled hypospadias. **Conclusion:** Repair of proximal crippled hypospadias carries a great challenge with large risk of subsequent complications. Redo repairs for recurrent hypospadias is associated with higher fistula and reoperation rates when compared to primary repairs for proximal hypospadias.

Keywords: Hypospadias, Hypospadias cripples, Surgical flap

1. Introduction

Hypospadias is a congenital anomaly of the male urethra that results in abnormal ventral placement of the urethral opening and is associated with abnormal foreskin development and penile curvature. The location of the displaced urethral meatus may range anywhere within the glans penis, the shaft of penis, the scrotum, or perineum (Van der Horst & De Wall, 2017).

Hypospadias is one of the most common congenital anomalies, with an incidence that varies from 0.3 to 0.7 percent in live male births (Kharbanda et al., 2021)

Hypospadias is usually classified according to the anatomic location of the urethral orifice: (1) distal hypospadias (urethral orifice located on the glans or distal shaft of the penis), (2) middle shaft (penile) hypospadias, and (3) proximal (penoscrotal, scrotal, or perineal) hypospadias (Hadidi, 2004).

The proposed mechanism for the pathogenesis of hypospadias is disruption of the androgenic stimulation required for the development of the normal male external genitalia. Both genetic and environmental factors that negatively affect androgenic stimulation have been associated with hypospadias, suggesting that in some cases, the etiology is multifactorial (Ollivier et al., 2018).

The goal of surgical correction is to create a penis with normal function and appearance with a urethral opening as close as possible to the ventral tip of the penis. Surgical

correction should result in a properly directed urinary stream and a straightened penis upon erection (Kisa et al., 2020).

The most common complication occurring after hypospadias repair is urethro-cutaneous fistula (UCF) with a reported incidence varying from 4 to 28% (Yadigar et al., 2019).

Hypospadias cripples can be defined as patients with persisting functional complications after previous hypospadias repair (Sakr et al., 2017).

Patients labelled as 'hypospadias cripples' pose a challenge to reconstructive surgeons because of the complexity of the problem and limited options for reconstruction (Gill & Hameed, 2011).

An ideal salvage hypospadias repair should restore urethral continuity of adequate caliber, eliminate intrinsic or iatrogenic penile curvature and provide a cosmetically pleasing circumferential skin closure. Repeated hypospadias surgery is predisposed to failure if it relies on surgically damaged or inadequate tissue. We believe that the chances for success are improved if healthy skin from the dorsum can be transferred to the ventrum (Patel et al., 2005).

Patients and Methods

This concomitant study including 35 patients with crippled hypospadias managed with tubularized vascularized skin flap from dorsal penile skin with a modification of skin covering at Al-Azhar university hospitals from November 2019 till May 2021.

Volume 10 Issue 11, November 2021

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Ethical considerations

All patients involved in this study gave an informed written consent, Patient's approval and local ethical committee also taken.

Inclusion criteria:

Patient presented with crippled hypospadias with all of the following criteria:

- Proximal type of hypospadias
- Failed primary repair (recurrent)
- Prepuce removed or used in first repair (circumcised)
- Healthy dorsal penile skin

Exclusion criteria:

- Primary cases
- Distal type of hypospadias
- Recurrent proximal hypospadias with preserved prepuce

Each patient will be subjected to:**a) Detailed history taking.**

- Personal data.
- Complaint: proximal recurrent penile hypospadias

b) Full clinical examination (general and local).

General examination for associated anomalies

Local examination for:-

- Penile size
- Degree of chordee
- Scarring of urethral plate
- Dorsal and Ventral skin condition
- Position, shape, and width of the urethral orifice
- Presence of the testis and shape of the scrotum

Investigations

- CBC
- Bleeding profile
- Urine analysis

Pre-operative preparation:

Children underwent evaluation of functional health status and a preoperative evaluation by an anesthesiologist & pediatrician.

Operative procedure

Starting with circum-cronal incision and another parallel incision with the width of skin flab vary according to age and the size of the penis with minimum width 6 mm. Divide the remaining part of dorsal penile skin $\frac{1}{4}$ and $\frac{3}{4}$ with an oblique incision in which the new urethra kept attached to the largest portion. Fashioning the distal part of dorsal penile skin to make new urethral tube in continuity with remaining dorsal penile skin. Tubularization of the flap over 10 or 12 fr tube according to age of the patient and penile size then replace with a smaller caliber one. Rotate the new urethra concomitant with its skin coverage to the ventral aspect of the penis. Proximal anastomosis between the hyposadic urethra and new urethra accomplished after insertion of the catheter to the urethra using simple interrupted 6/0 polyglycolic acid sutures. Great care must be exercised when positioning first sutures in the proximal anastomosis to keep

the suture line of the new urethra facing the corpora not the skin to decrease the incidence of fistulae. Division of the glans penis in the midline preparing for Glanuloplasty and positioning of the tube of new urethra. Great care must be also exercised when positioning first sutures in the distal anastomosis to keep the suture line of the new urethra facing the corpora to avoid mild flap rotation. Distal anastomosis between the glans penis and new urethra accomplished using simple interrupted 6/0 polyglycolic acid sutures concomitant with glanuloplasty. The other portion of dorsal penile skin rotated to the opposite direction to share in covering the ventral aspect of the penis and doing counter rotatory force aiming to prevent post-operative penile rotation. Direct suture the dorsal skin to the remaining part at coronal sulcus. Ventral skin closure by approximating rt and lt portions of divided dorsal penile skin together and at coronal sulcus with vertical mattress 5/0 polyglycolic acid sutures. Fixation of the catheter while keeping the tip and pores just proximal to the bladder neck to be dependent. Closed dressing with gentle pressure of the penis against the abdominal wall. The dressing kept unchanged for 4 days unless soaked. Catheters removed on 8th post operative day.

Post-operative follow-up:

Clinical follow up for 6 months to observe:

- Wound Infection
- Meatal stenosis
- Glans dehiscence
- Repair disruption
- Any residual chordee
- Penile rotation
- Urethrocutaneous fistula
- Urethral stricture
- Urethral diverticulum
- Urine stream direction
- Contracted penis
- Ischemic skin changes
- Cosmetic appearance

2. Statistical Analysis

Data was collected, coded then entered as a spread sheet using Microsoft Excel 2016 for Windows, of the Microsoft Office bundle; 2016 of Microsoft Corporation, United States. Data was analyzed using IBM Statistical Package for Social Sciences software (SPSS), (IBM SPSS Statistics for Windows, Version 26.0. Armonk, NY: IBM Corp). The Kolmogorov-Smirnov test was used to verify the normality of distribution. Continuous data was expressed as mean \pm standard deviation, median & IQR while categorical data as numbers and percentage.

3. Results

This study was done among 35 patients with crippled hypospadias who managed with tubularized vascularized skin flap from dorsal penile skin with a modification of skin covering at Al-Azhar university hospitals.

Table 1: Clinico-demographic and preoperative characteristics in the studied patients

Parameters		Studied patients (n=35)	
		n	%
Age (years)	Mean± SD	6.06± 3.14	
	Median (IQR)	5.5 (3.5-8.0)	
	Range	2-13	
	2-5 years	17	48.6 %
	6-9 years	13	37.1 %
Previous repair	10-13 years	5	14.3 %
	Once	16	45.7 %
	Twice	12	34.3 %
	Three times	5	14.3 %
	Four times	1	2.9 %
	Five times	1	2.9 %
	Mean± SD	1.83± 0.99	
Range	1-5		
Position of the urethral meatus	Penoscrotal	13	37.1 %
	Perineal	4	11.4 %
	Posterior penile	18	51.4 %
Preoperative chordee	No	25	71.4 %
	Yes	10	28.6 %

SD= standard deviation, IQR: interquartile range

Table (1) shows clinico-demographic and preoperative characteristics in the studied patients. A total of 35 patients were included in this study. The age of patients ranged from 2 to 13 years with mean age ±SD being 6.06± 3.14 years. The most common age involved in our study was between 2-5 years (48.6%). All patients underwent previous repair with mean 1.83± 0.99 times. Sixteen (45.7%) patients had undergone a single hypospadias repair, 12 (34.3%) were previously repaired twice, 5 (2.9%) had 3 previous repairs and each one patient had 4 and 5 previous repairs. Posterior penile position was the most common position for urethral meatus (51.4%). Preoperative chordee was found in ten (28.6%) patients.

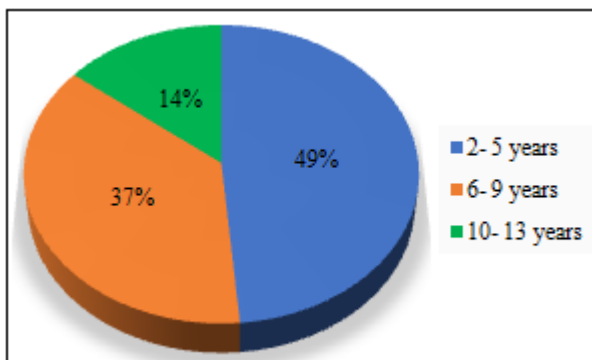


Figure 1: Pie chart showing age distribution in the studied patients

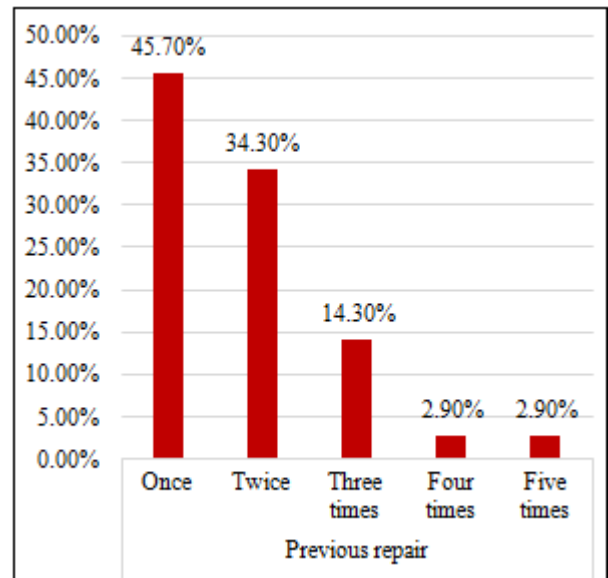


Figure 2: Bar chart showing previous repair times in the studied patients.

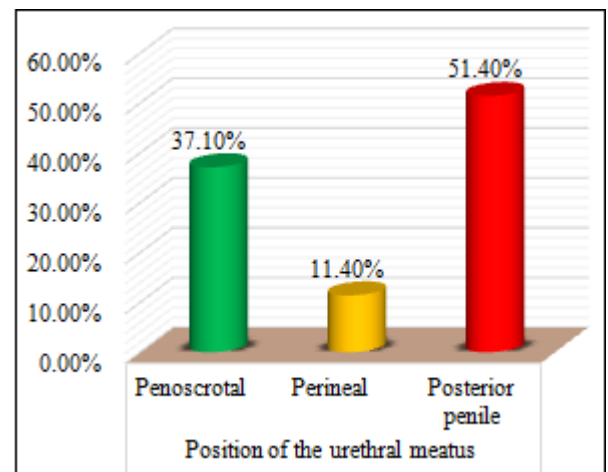


Figure 3: Bar chart showing distribution of position of the urethral meatus in the studied patients

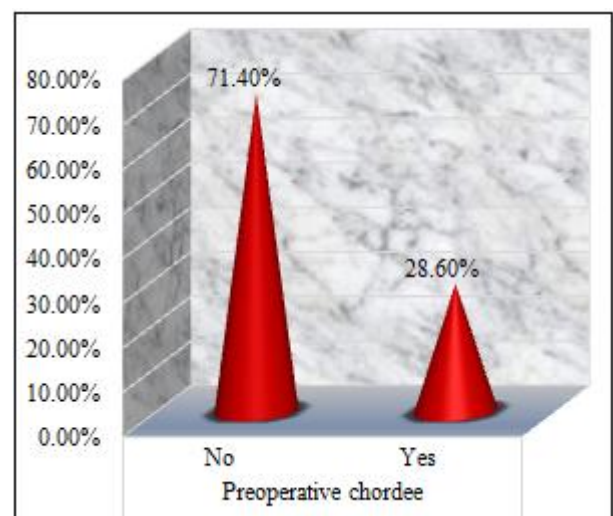


Figure 4: Bar chart showing distribution of preoperative chordee in the studied patients

Table 2: Operative characteristics in the studied patients

Parameters		Studied patients (n=35)	
		n	%
Operation time (minutes)	Mean± SD	102.0± 21.29	
	Median (IQR)	100.0 (85.0-120.0)	
	Range	75.0-160.0	
Stent time (days)	Mean± SD	8.8± 1.76	
	Median (IQR)	8.0 (8.0-10.0)	
	Range	6.0-14.0	

SD= standard deviation, IQR: interquartile range

Table (2) shows operative characteristics in the studied patients. The operation time ranged from 75-160 minutes with mean ±SD was 102.0± 21.29 minutes. The mean ±SD stent time was 8.8± 1.76 days with range 6-14 days.

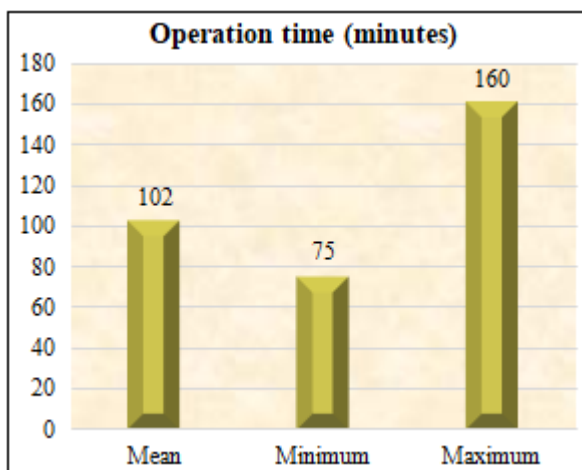


Figure 5: Bar chart showing mean and range of operation time in the studied patients

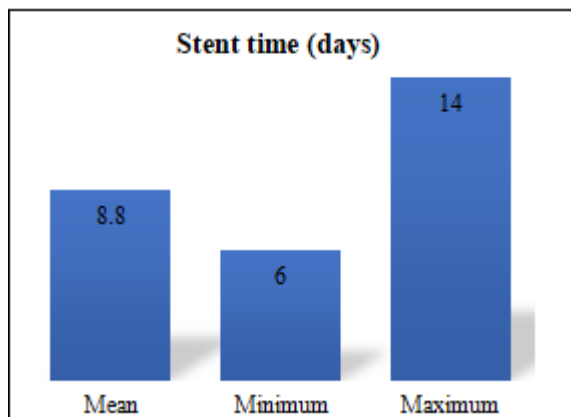


Figure 5: Bar chart showing mean and range of stent time in the studied patients

Table 3: Postoperative complications in the studied patients

Parameters	Studied patients (n=35)	
	n	%
Wound infection	6	17.1%
Urethrocutaneous fistula	9	25.7%
Urethral diverticula	4	11.8%
Meatal stenosis	7	20.0%
Glans dehiscence	4	11.4%
Urethral stricture	4	11.4%
Recurrent chordee	4	11.4%
Penile rotation	3	8.6%
Contracted penis	2	5.7%
Poor cosmetic outcome	8	22.9%

Ischemic skin changes	2	5.7%
Recurrence	4	11.4%

Table (3) shows postoperative complications in the studied patients. Six (17.1%) patients had wound infections and 4 of them developed glans dehiscence. Appropriate antibiotics were used in these patients until the wound improved. Urethrocutaneous fistula had developed in nine (25.7%) patients. Urethral diverticula had developed in 4 (11.8%) patients. Seven (20%) patients had developed meatal stenosis. Four (11.4%) patients were experienced urethral stricture. Recurrent chordee was presented in four (11.4%) patients. Penile rotation was found in 3 (8.6%) patients while contracted penis was presented in 2 (5.7%) patients. Poor cosmetic outcome was presented in 8 (22.9%) patients. Ischemic skin changes were presented in 2 (5.7%) patients. Four (11.4%) patients experienced recurrence.

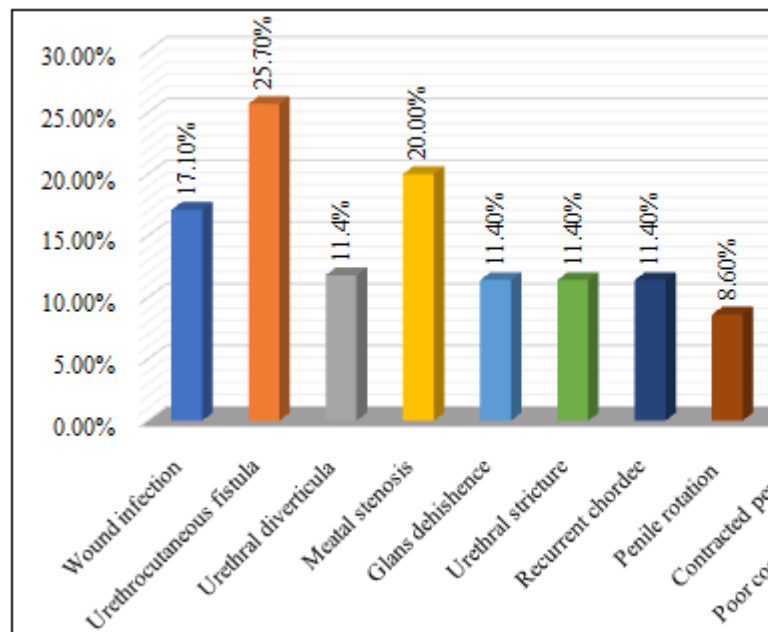


Figure 6: Bar chart showing distribution of postoperative complications in the studied patients

Table 4: Total complication and success rate in the studied patients

Parameters	Studied patients (n=35)	
	n	%
Complication rate	12	34.3%
Success rate	23	65.7%

Our study revealed that the total complication rate in our studied patients was 34.3% while the success rate found was 65.7%.

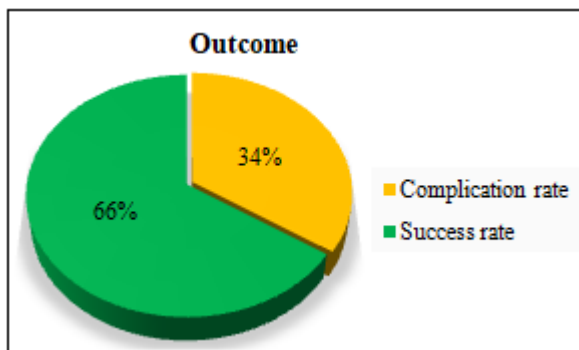


Figure 7: Pie chart showing distribution of outcome in the studied patients.

4. Discussion

Hypospadias is a common genital anomaly that occurs in 0.2–0.6% of the males. The rate of early complications after the first surgery is about 10%. However, the long-term complication rates are significantly higher (Pandey et al., 2017).

Revision surgery for hypospadias in patients who have had multiple previous operations is a difficult and challenging task. In revision surgery for hypospadias, the paucity of available skin, the presence of uncorrected curvature, the lack of vascularized tissues, and the position of the meatus are challenges that have to be overcome (Safwat et al., 2013).

Although many different techniques are described and used for secondary hypospadias repair, there is no one superior method. Complication rates after repair of secondary hypospadias can be up to 57% (Turkyilmaz et al., 2020).

Snodgrass and Bush indicated that urethroplasty complications doubled in those undergoing a second hypospadias urethroplasty compared to those undergoing a primary repair (Snodgrass & Bush, 2017).

This risk increased to 40% in patients with 3 or more reoperations. Each surgery increases the odds of additional complications 1.5-fold. Mid and proximal meatal positions and small glans significantly increase the complication rate (Turkyilmaz et al., 2020).

The failed hypospadias repair is a surgical challenge for many reasons; the remaining penile skin will have some degree of scarification, the blood supply will be variable and less defined, natural tissue planes are obliterated and less skin is generally available. In this study we showed that despite these hurdles dorsal penile skin can successfully be used to base a pedicle flap.

So, this study aimed to evaluate the use of tubularized vascularized skin flap from dorsal penile skin with a modification of skin covering in management of proximal hypospadias cripples.

This study was done among 35 patients with crippled hypospadias who managed at Al-Azhar university hospitals from November 2019 till May 2021.

Our study revealed that the total complication rate in studied patients was 34.3% while the success rate found was 65.7% with normal urine stream and accepted cosmetic appearance.

Badawy et al., reported success rate after the second stage was 56% (14 children), and complications were encountered in 44% (11 children) after staged repair of redo crippled hypospadias (Badawy et al., 2019).

In another prospective, randomized, controlled study was conducted during the period from July 2015 to October 2017 at Menoufia University Hospitals on 30 patients presented with crippled hypospadias. Successful repair was done for 19 (63.3%) patients, complications occurred in 11 (36.6%) patients (Lolah et al., 2020).

In our study urethrocutaneous fistula had developed in seven (20%) patients. Two of them was single minor fistula which closed spontaneously but other 5 cases need operative closure.

Obaidullah reported 8 (17.8%) urethrocutaneous fistulae during repair of complicated hypospadias with islanded scrotal raphe flap (Obaidullah et al., 2021).

In another study over 16 patients salvage hypospadias repair done from dorsal and lateral penile skin fistulas developed in 4 (25%) patients (Jayanthi et al., 1994).

Eleven out of 39 patients (28.2%) reported by Turkyilmaz had urethrocutaneous fistulae during comparison between 3 different techniques during redo hypospadias repair (Turkyilmaz et al., 2020).

Five cases (14.3%) developed meatal stenosis in our study. Three of them improved with repeated dilatation and the remaining 2 patients underwent meatoplasty.

Lolah et al., reported meatal stenosis affecting four (13.3%) patients in redo surgery for hypospadias cripples (Lolah et al., 2020).

Our result of urethral stricture was 4 (11.4%) patients.

The reported prevalence of urethral strictures after hypospadias repair is 6–12%, and hypospadias surgery is the major cause of urethral stricture formation in adults aged <45 years (Lumen et al., 2009).

We reported 4 (11.4%) patients with recurrent chordee in our study.

According to Chandra et al., 6 (16.2%) patients had persistent chordee after redo repair for crippled hypospadias in a tertiary care center (Chandra et al., 2021).

Penile torsion deformity may result when only flap/tube repair is done, the vascular pedicle is used as second layer healthy tissue, improper closure of skin flaps, and uncorrected torsion associated with hypospadias. There are more chances of torsion in single dartos flap as compared to double dartos flap (Kamal, 2005).

Our study reveals 3 (8.5%) cases of penile torsion 2 of them less than 30° and the other one was greater and associated with ischemic opposite skin flap which needs correction 6 months later.

We reported 3 (11.4%) urethral diverticula in our present study two of them associated with meatal stenosis.

Urethral diverticulum developed in 5 (12.8%) cases out of 39 during comparison of three different techniques of redo hypospadias repair (*Turkylmaz et al., 2020*).

In the present study, the age of patients ranged from 2 to 13 years with mean age 6.06± 3.14 years.

In this study the operation time ranged from 75-160 minutes with mean ±SD was 102.0± 21.29 minutes.

This is shorter than other redo hypospadias techniques operative time as reported mean Operative time ranged from 67 to 446 min (mean 157 min) (*Safwat et al., 2013*).

In another study the operative time of Full thickness skin tubular flap for crippled hypospadias was 116.87±16.67 which slightly longer than our result (*Turkylmaz et al., 2020*).

In the present study the mean ±SD stent time was 8.8± 1.76 days with range 6-14 days. Mean stenting duration was 12.00±1.51 days in redo hypospadias repair with Full thickness skin tubular graft (*Turkylmaz et al., 2020*).

This is an encouraging result. The technique has several advantages. Single stage, less complication rate and shorter operative time. Advantage of using local tissue instead of remote grafts. The flap has a good blood supply because the supplying vessels are close to the penile artery. They are not terminal branches as seen in the preputial flap. The flap is brought down to the ventral side of the penis from one side with counteraction force from opposite side that could avoid torsion of the penile axis.

In conclusion, our experience with 35 cases of proximal crippled hypospadias shows that urethroplasty using tubularized skin flap from dorsal penile side with modification can be used as an alternative technique with favorable results and low complication rate for repairing proximal crippled hypospadias.

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